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BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

FOREST INSECT INVESTIGATIONS

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SUMMARY OF FOREST INSECT CONTROL AND SURVEYS - ELDORADO NATIONAL FOREST

1912 - 1943

by

John M. Miller

Forest Insect Laboratory
Berkeley 4, California
November 30, 1944

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SUMMARY OF FOREST INSECT CONTROL AND SURVEYS, ELDORADO NATIONAL FOREST

1912 - 1943

Foreword

Up to the present time reports of forest insect conditions on the Eldorado have been made for the most part by the Forest Service. The Bureau of Entomology and Plant Quarantine has made and reported upon some examinations of special areas from time to time, but there has been a lack of any continuing program of bark beetle detection surveys in the past, such as have been maintained on National Forests in northeastern California and the more southern Sierras.

This absence of any sustained survey program on the Eldorado seems to have been due in part to the low loss level resulting from insect infestations in the commercial pine type during past years. While bark beetle epidemics have occurred on this Forest, they did not reach the high peak of timber losses and seem to have been of shorter duration than the more spectacular outbreaks in other parts of California. However, in the mixed conifer types of the Eldorado, conditions in the pine stands are quite similar to those in other parts of the region where severe epidemics have developed. The risk of future losses on the Eldorado is a factor which must be taken into account in the protection and management of its commercial timber stands and the forest cover on recreational areas.

It is the purpose of this summary to review and interpret what has occurred in the line of insect infestations on the Eldorado and to attempt a preliminary appraisal of the forest insect hazards that are involved on this Forest. The report is intended to serve as background material for Forest Officers who are charged with reporting upon forest insect conditions annually and Forest Insect Laboratory personnel who may be carrying out more detailed surveys in the future.

I. CHRONOLOGICAL SUMMARY

1912-1916

In November 1912 the Bureau of Entomology set up a forest insect field station at Placerville which was continued at this location until July 1916. Dr. H. E. Burke was in charge and during the four seasons that the station was in effect, he had several assistants. The primary program of this station was to study the biology of forest and shade tree insects in the California region. No extensive surveys of bark beetle damage were attempted on the Eldorado as most of the control and survey work of the Bureau during that period was located in other parts of the region. Burke, however, recorded an epidemic group killing of ponderosa pine by Ips confusus and the western pine beetle in the vicinity of Placerville during 1914-15. At the request of Mr. Davis of the Smith Lumber Company an investigation was made of bark beetle infestations in the Silver Creek tract where only endemic conditions were found. In 1916 the research program of the Placerville station was assigned mainly to insect problems affecting park and shade trees and the station was moved to Los Gatos, California.

1917

The first extensive bark beetle survey of the Eldorado was made by A. J. Jaenicke during the summer of 1917. This survey was part of a special study undertaken cooperatively by the Forest Service, the Bureau of Entomology and the larger timber holding companies of the central California region. The project was undertaken to evaluate the bark beetle problem in the westside pine type of the Eldorado, Stanislaus, Sierra and Sequoia National Forests. Although this initial survey of the Eldorado was not followed up by subsequent surveys or control work, it has been of considerable value in providing a record of the bark beetle conditions at that time.

Jaenicke, who was detailed from the Office of Forest Management of Region Six, was assisted on the survey by Albert Wagner and H. A. Smith. A coverage of the Forest was made by topographic viewing and road counts of infested trees, supplemented by two large plots which were intensively cruised. From the sample data thus obtained, the volume of beetle-caused losses were estimated for the year 1917.

Since the private companies were especially interested in the results of the survey and contributed to its cost, Jaenicke gave special attention to the more valuable commercial timber; and he eliminated from the survey a considerable acreage of forest lands where timber values were low. The following table is extracted from his report.

Table 1. TIMBER STANDS IN MBM, ELDORADO NATIONAL FOREST - 1917

	Total stand		Stand included in survey	
	Ponderosa pine	Sugar pine	Ponderosa pine	Sugar pine
1. Within the Forest:				
Forest Service	1,168,000	415,000	818,000	353,000
Alienated	2,788,000	786,000	2,004,000	625,000
Totals	3,956,000	1,201,000	2,822,000	978,000
2. Outside the Forest:				
Alienated	104,000	33,000	104,000	33,000
3. Totals all areas	4,060,000	1,234,000	2,926,000	1,011,000
4. Total stand, both species	5,294,000		3,937,000	

Thus the 1917 survey included approximately 75 percent of the estimated pine stands of the Eldorado. Jaenicke divided the Forest into 12 entomological or reporting units and estimated the losses for each unit.

Table 2. LOSS ESTIMATES BY UNIT - 1917

Name of Unit	Approx.	1917 Pine Loss Ft. B.M.		Annual B.F. loss per A.	Status of Infestation	
	Acreage	P. Pine	Sugar Pine			Total
Bear River	24,500	190,344	9,000	199,344	8	Increasing
Caldor	35,000	377,435	54,000	431,437	12	Increasing
Cape Crossing	29,500	195,225	18,000	213,225	7	Balanced
Pyramid	52,000	162,687	45,000	207,687	4	Decreasing
Iron Mtn.	33,000	179,635	30,000	209,635	6	Balanced
Pacific	17,000	103,536	7,263	110,799	6	Balanced
Silver Creek	50,000	57,507	32,683	90,190	2	Balanced
Little So. Fork of Rubicon	14,000	38,346	7,263	45,609	3	Balanced
Uncle Toms	35,000	46,016	130,734	176,750	5	Decreasing
Pino Grande	11,000	46,016	21,789	67,805	6	Decreasing
Georgetown	57,000	264,592	43,578	308,170	5	Balanced
Pilot Creek	27,000	61,355	18,157	79,512	3	Decreasing
Totals	385,000	1,722,694	417,467	2,140,161	5	

These estimates indicated that the volume of pine timber killed during the year 1917 amounted to about one-twentieth of one percent of the stand; or if applied to the acreage, an average loss of about 6 board feet per acre. The highest losses noted were in the Caldor unit where they averaged a little over 12 board feet per acre. The recommendations of the survey were: "Inasmuch as the infestation now existing is of the so-called 'normal' character and involves such a small percentage of the stand, no control measures are at present necessary for the protection of the remaining timber."

Jaenicke, A. J. Forest Insect Survey - Eldorado N.F., 1917. October 1917

1918-1924

During this period we find no reports or records of insect infestations on the Eldorado. It can be assumed that the very low status of bark beetle infestations in the commercial pine belt reported by Jaenicke persisted throughout this period. However beginning in 1925, we find reference to conditions on the Eldorado in the annual Insect Control Reports by the Regional Forester. This information was summarized from reports by the field officers of the Forest Service. The following quotations are from the Regional Office summaries except where other reports are given as references.

1925

"Two ranger districts estimate less than 10 trees per section; losses were noted in ponderosa pine and white fir."

1926

No report

1927

No report

1928

"(infestations) generally normal; Slate Mountain, Mokelumne Slope, and Lake Valley should be watched for increase in western yellow pine infestation. Lake Valley estimates 1400 lodgepole pine and 340 white fir on 4400 acres."

1929

"Endemic except on special areas. Lake Valley - epidemic in white fir and lodgepole, 4500 acres, 20% government, Supervisor requests \$500 for control; Caldor - heavy infestation in white fir poles, area should be watched and special examination made; Slate Mountain - 600 sugar pine and western yellow pine on 3800 acres, 60% government, control not recommended."

1930

"Endemic except on special areas. Echo Lake (recreation area), 200 white fir and lodgepole, 50% government. Special examination to be made by Bureau of Entomology, spring of 1931, and control begun in June with surplus control money."

J. M. Miller made an examination of the Lake Tahoe and Echo Lake areas in September and reported, "For the past several years the dying of coniferous trees has been the cause of much concern on the part of land owners in the Lake Tahoe region. These conditions became noticeably worse during the season of 1929, especially in white fir. The season of 1930 has shown very little evidence upon which to expect improvement."

Miller, J. M. Forest insect infestations in the Lake Tahoe Region. Oct. 10/30

Miller grouped the insects involved in these losses into two distinct types of infestation: (1) pine beetles Dendroctonus which were killing ponderosa, Jeffrey, sugar and lodgepole pines; and (2) the fir engraver beetles, Scolytus, which were injuring and killing white fir and red fir. He recommended that direct control measures be considered by the owners in dealing with the pine beetle infestations. Control measures were not recommended for the fir engraver beetle because both disease and insect factors appeared to be involved, and the problem called for a study before effective control methods could be proposed.

1931

"From an extensive examination by members of the Forest Service in the western yellow pine type in the American River Canyon, it appears that incipient epidemic conditions exist in an area of about 20,000 acres, 53 percent privately owned.

"The Ruggles interests have made a proposal for a cooperative survey in the northwestern portion of the Stanislaus and southwestern portion of the Eldorado next season, which it is hoped may be conducted.

"Special areas mentioned:

"American River Canyon - 20,000 acres, 47% government, 4000 WYP. Special examination requested.

"Brush Creek - 5000 acres, 90% government, 1100 WYP. Special examination and control.

"Mokelumne Hill - 5000 acres, 44% government, 816 WYP. Special examination and control.

"Mokelumne River Slope - 7600 acres, 90% government. No estimate of infested trees. Area should be watched and special examination made if the infestation increases.

"Silver Creek - 2000 acres, 67% government, estimate of red fir infestation. Special examination and control provided PG&E Company will cooperate.

"Wrights Lake - 6400 acres, 100% government. Special examination."

The Echo Lakes Control Project.

A fund of \$445 was set up to carry out the control work on this recreational area. Work was started on May 16 and completed by June 30. A three-man crew was organized by A. N. Weber of the Placerville office and G. R. Struble of the Forest Insect Laboratory contributed time for the spotting. Results of the project were summarized by Struble.

Struble, G. R. Echo Lakes Control Project, 1931. Nov. 17/31

"Acreage covered	1,482		
Amount treated		<u>No. trees</u>	<u>Volume</u>
Lodgepole pine		76	38,640
White pine		24	23,370
Total		<u>100</u>	<u>62,010</u>
Costs	\$445.35		

The effectiveness of this control work was shown by a survey made in September 1931 when only four newly infested trees could be found in the project area, indicating a reduction of around 96 percent.

1932

"General increase of infestation in all except low altitude types. Heavy losses in white fir and red fir in Georgetown and Caldor districts.

"No spring control work was done in the Echo Lakes area. A survey this fall disclosed about 25 infested trees within this project area. Since this is a tract of considerable recreational importance, an allotment of \$150 of G. E. money has been made to treat these trees next spring.

"The local Forest officers cooperated with Miss Anita Baldwin last spring on her estate near Fallen Leaf Lake. At the same time a small number of trees on adjoining government land were treated.

"The infestation on the Ruggles lands and intermingled national forest areas appears to have subsided considerably. No special examination of this area was made.

"Special areas mentioned:

"Mosquito and Brush Creeks - 24 ponderosa pine and sugar pine and 24 Douglas fir per section, 65% government. Special examination requested.
"Silver Lake - increasing fir losses, 80% government. No recommendations.
"Fir belt in Georgetown district - 1,920 red fir, white fir and lodgepole per section in about equal numbers, 85% government. No recommendations.
"Lake Valley - increasing infestation in lodgepole pine, Jeffrey pine and red fir, 10% government. Control recommended if private owners will co-operate."

The Fallen Leaf - Lake Tahoe Control Project.

A special report on this project was submitted by Struble. Following a

Struble, G. R. The Fallen Leaf - Lake Tahoe Control Project. Mar. 6/33

survey in September 1931 by A. N. Weber and R. Bryan, plans and cooperation were developed with the private land owners to start control work. Through funds provided by the Baldwin estate, work was started in October 1931. Only a partial treatment of the area was accomplished before winter and the work was resumed the following April and completed in June. Both Jeffrey pine and lodgepole pine were treated, but are not separated in the report.

"Total acreage	2600		
Amount treated		<u>No. trees</u>	<u>Volume b.f.</u>
		292	446,970
Costs			
Government	\$ 79.96		
Baldwin estate	<u>1,261.70</u>		
Total	<u>\$1,341.66</u>		"

A recheck of this area by Struble in the fall of 1932 found 97 percent reduction in the lodgepole infestation and 44 percent in Jeffrey pine.

1932

"In the late fall of 1932 a cooperative control project on the Baldwin estate and adjoining national forest lands under which only a few trees were treated on national forest lands.

"Late in the fall of 1933 and during the present winter, control work has been conducted under a NIERA project in the South Fork of the American River Canyon. The project area comprises about 19,000 acres, with a total of about 1,110 trees (chiefly ponderosa pine) to be treated at a cost of about \$7,500."

1934

"Examinations made this year by members of the Bureau of Entomology and Plant Quarantine have shown that there is only one area of serious epidemic infestations. This is an excellent site quality area in the sugar pine-fir type bordering the large Kyburz burn which occurred in

1932. This epidemic is concentrated on an area of about 800 acres where about 300 sugar pines are infested with the mountain pine beetle and flat-heads. It is planned to carry on control with CCC labor this winter or early next spring if the transportation problem can be solved satisfactorily.

"Last winter a NIRA control project was conducted in ponderosa pine stands along the American River Canyon and within view of the Lincoln highway. Infestation here was not much more than of endemic proportions, but control was deemed advisable chiefly for esthetic reasons. About \$5,600 was expended. (Records indicate 1,050 snags and infested trees were removed.) It is planned to continue this control work this winter with CCC labor along the north side of the canyon in T.11 N, Rs 13 and 14 E; and also to rework some of the area covered last year where group killing is occurring."

J. E. Patterson of the Forest Insect Laboratory made a special examination of the American River Canyon in September of this year and submitted a report. Patterson proposed three units for control work which took into

Patterson, J. E. Present status of forest insect condition in south fork of American River Canyon. September 23/34

account the types of infestation:

Unit 1. The area bordering the Kyburz burn in the sugar pine-fir type, covering about 5,000 acres. Epidemic conditions were concentrated in sugar pine on about 800 acres in the vicinity of High Cliff.

Unit 2. The south slope area opposite the Pacific Ranger Station, covering about 12,000 acres. The infestation type here was practically all ponderosa-western pine beetle. While losses were not epidemic, they had been persistent and resulted in an accumulation of snags highly visible from the Lincoln highway.

Unit 3. A continuation of Unit 2, including the ponderosa pine type on the south slopes of Peavine ridge eastward from Riverton, covering about 9000 acres. Although some groups occurred, the infestation was not considered epidemic. Maintenance work was suggested in connection with the control operations in Unit 2.

1935

"From observations made by members of the Bureau of Entomology this fall, it was found that the heaviest losses occur on the slopes of the Mokelumne River at the southern edge of the forest, where about 45 trees per section were killed this fall. This is not considered of sufficient consequence to warrant control work at this time.

"Endemic infestations continue in the American River Canyon, the route of the Lincoln highway. In view of the intensive recreational use of this area, Forest Supervisor Smith considers it advisable to treat infested trees by CCC labor this winter and next spring. Probably not to exceed 100 trees will be treated on an area of about 5000 acres.

"The flareup of mountain pine beetle infestation in sugar pine stands bordering the Kyburz Burn has now completely subsided."

1936

"Infestations remain normal or sub-normal. No control work was done in 1936."

1937

"Low endemic infestations in both ponderosa pine and sugar pine are reported in these forests (Eldorado, Tahoe and Stanislaus). Red and white fir losses continue on about the same scale as last year."

1938 "Endemic infestations prevail throughout this Forest."

1939

"Except at the southern end of the Forest in the Mokelumne River drainage where increased losses in both ponderosa and sugar pines were noted, it appears that endemic infestation conditions continue to prevail in this Forest."

1940

"The only rather heavy infestation in this Forest was reported by Forest officers in the Mosquito and Slate Mountain areas. There direct control with CCC forces is being undertaken in the spring of 1941."

1941

"Endemic infestation conditions prevail generally throughout this Forest. Exceptions are:

- a. The Tunnel Hill area, in the Georgetown district, where on about 3000 acres the infestation amounts to about 15 trees per section (mostly ponderosa pine). Since this is largely private lands and it has been impossible to secure cooperation from the owners, no control has been practicable.
- b. The Lake Valley area where Jeffrey pine infestation has increased materially. This, too, is chiefly on patented lands and here again it has not been possible to secure cooperation for control work.

Control projects - winter and spring of 1941

Two control jobs were carried out with the aid of CCC forces.

Name of Project	<u>Blair's Mill</u>	<u>Slate Mountain</u>
Duration	<u>March 1941</u>	<u>January & February 1941</u>
Tree species	P. pine	P. and sugar pines
Insect species involved	Western pine beetle	Western pine beetle; <u>Ips</u> , Mountain pine beetle
Total Acreage	1,000	6,000
No. trees treated	80	403
Volume treated	16 MBM	257 MBM
Total cost	\$167.25	\$2,740.50

1942

An examination was made of the American River Canyon and Lake Valley areas in September by J. M. Miller of the Forest Insect Laboratory. This was reported in a memorandum to the Forest Supervisor. Miller reported light endemic infestations in the Canyon area and an endemic, but apparently increasing, Jeffrey pine beetle infestation in Lake Valley area below Luther Pass. The engraver beetle infestation in fir was much reduced from former years, but there was some evidence of recent activity still going on.

Topkilling of ponderosa pine was investigated in the vicinity of Berry Mill in Clear Creek. This was an Ips infestation which killed only the tops of scattered trees and was not epidemic or accompanied by any serious western pine beetle attack.

1943

Topkilling of ponderosa in the vicinity of the Institute of Forest Genetics was investigated by Miller at the request of Mr. Weidman. Miller reported by letter that "The area affected is in the lower ponderosa pine belt between the elevations of 2000 and 4000 feet. The trees attacked occur singly. They are widely scattered at the rate of about 25-30 per section. Grouping is rare, not more than 2-3 trees being noted in any one group. The topkilling reported in 1942 near Berry Bros. Mill had subsided.

"American River Canyon. Viewed from highway 50 between Pacific R.S. and Kyburz bark beetle infestations have reached the lowest point in recent years and losses are negligible.

"Lake Valley. The infestation in Jeffrey pine has decreased. Recent sawmill operations in the old stands near Myers may have had some influence by trapping the Jeffrey beetle infestation in the surrounding area."

II. INFESTATION TYPES IN THE MORE IMPORTANT CONIFERS

Surveys and control work on this Forest have encountered the more common infestation of bark beetle infestations found on the western slopes of the Sierras. In the discussion which will follow of conditions by areas, these infestation types will be referred to under the names and definitions listed below. This list includes all of the tree species for which reports of insect-caused losses are available. Although incense cedar has been taking on some commercial importance in recent years, it has been given little attention in surveys and insect problems concerned with this tree species require further study.

PONDEROSA PINE

1. Western pine beetle (Dendroctonus brevicornis). When in the endemic stage this beetle selects and attacks mainly mature trees of slow growth rate; when epidemic, it is less selective and attacks groups of trees with only minor selection by growth rate. These epidemic conditions are often associated with initial outbreaks of Ips beetles.

2. Ips confusus. Attacks the tops of larger trees and in young stands kills entire groups of pole size. It breeds very commonly in slash and windfalls, but in attacking living trees shows very little selection by growth rate or tree vigor. Its attack in the tops of larger trees is often followed by the western pine beetle in the main bole. Its outbreaks in standing trees are sporadic and are frequently connected with infestation developing from nearby slash.

SUGAR PINE

1. Mountain pine beetle (Dendroctonus monticolae). The more serious timber losses caused by this beetle occur in large mature trees, but it also attacks younger aged trees without evident selection by growth rate. Group attacks are not common so that infestations in sugar pine have not acquired the spectacular proportions of western pine beetle epidemics.

2. Ips confusus. Attacks the tops of large sugar pines and occasionally young trees in groups.

JEFFREY PINE

1. Jeffrey pine beetle (Dendroctonus jeffreyi). At the higher elevations on the westside and in the eastside type large mature trees are attacked singly and usually in scattered distribution.

2. Pine flathead (Melanophila californica). On the drier sites and when trees are suffering from drought, this insect may attack trees of all age classes.

LODGEPOLE PINE

1. Mountain pine beetle. In this host tree, attacks of the mountain pine beetle occur most frequently in groups and when epidemics develop widespread killing occurs of trees above 6 inches in diameter.

WHITE FIR AND RED FIR

1. The fir engraver beetle (Scolytus ventralis). This beetle attacks living fir regardless of age or thrift. It has the habit of partially infesting the bole causing top-killing and dead limbs; and it may repeatedly attack the same tree season after season. When it becomes aggressive, trees are killed outright in one year, frequently in groups. An immense amount of fir losses and the decadent condition of stands in areas of the Eldorado are due to the work of this insect.

DOUGLAS FIR

1. Douglas fir beetle (Dendroctonus pseudotsugae)
2. Douglas fir flathead (Melanophila drummondii)

Burke reported both of these insects in the Mosquito Creek area in 1913. Records of attack by either of these species are missing in recent surveys, but they may have been involved in the loss of Douglas fir in the Mosquito and Brush Creek areas reported by the Forest Service in 1931.

III. FOREST INSECT CONDITIONS BY TIMBER MANAGEMENT WORKING CIRCLES

The common practice in reporting upon forest insect surveys is to break down a large area, such as a national forest, into smaller units for convenience in summarizing conditions and in making specific recommendations. Entomologically these should be true infestation units in the ideal sense; i.e. areas in which conditions affecting the insects are fairly uniform and the trends within a unit are the same throughout the area included. In mixed type and uneven topography, such ideal areas rarely exist and as a result the reporting units established by bark beetle surveys are usually arbitrary areas. Their selection is governed largely by administrative considerations, topography, type conditions, logging developments and general expediency.

In the 1917 survey Jaenicke set up infestation units for the Eldorado which appear to have been selected to considerable extent on the basis of topographic features. These have not been used since as reporting areas and many developments have taken place during the long interval of time since Jaenicke's survey. Some units have been cutover to such an extent that comparison of recent loss estimates with those of 1917 would have little significance.

If new infestation units are established to serve a continuing bark beetle survey program, they should be selected with attention to the stand, type and climatic conditions that tend toward homogeneous behavior of infestations within individual units. Because of lack of time no attempt was made to establish new infestation units in the 1944 Eldorado survey; instead the established forest management working circles were used as the reporting areas for reviewing and analyzing infestation conditions within the commercial pine types. These working circles can be made to serve the purpose of reporting areas until more adaptable infestation units are outlined by field surveys. The advantages of using the working circles as reporting areas for the present are that they have recognized boundaries, available stand estimates and composition data, and are under management plans which have been or will be developed. Plans for either direct or indirect control can be worked out to good advantage for areas where this basic management data are available.

A review was made of all forest management working circle plans now on file and stand data pertinent to infestation conditions were summarized. For reference in future forest insect surveys, this information has been condensed in Table 3. Working circle boundaries are shown in map-fig. 1.

Table 3. ACREAGE AND STAND DATA BY WORKING CIRCLES - ELDORADO NATIONAL FOREST

Working Circles:	1 Auburn (Long Canyon)	2 Big Bend	3 Alder Creek Silver Fork	4 Caldor	5 Clear Creek	6 Amador	7 * Silver Creek	8 * George- town	9 * Plum Cr.
YEAR APPRAISAL	1944	1939	1939	1940	1940	1941	1940	1940	1940
TIMBERED ACREAGE									
Gov't	21,312	12,990	20,273	26,960	3,212	11,450		10,486	8,640
Private	16,706	8,728	10,792	23,712	8,288	4,624	83,500	10,336	12,517
Total	38,518	20,718	31,065	50,672	11,500	16,074		20,822	21,157
CUTOVER ACREAGE									
Gov't	none	1,430	663	17,419	420	65			3,000
Private		990	800	15,034	3,784	150			7,500
Total		2,420**	1,463	32,453	4,204	215			10,500
VIRGIN STAND PER ACRE									
Gov't	33,223	25,268		29,447		30,071			
Private	40,799	28,402		11,006		34,317			
Average	37,011	27,808	27,765	20,132	24,908	31,292			
MERCHANTABLE VOLUME MBM									
Gov't	724,660	328,229		659,091	88,901	310,000	1,300,000*	240,208*	40,000*
Private	681,256	247,893		140,295	88,989	187,000			
Total	1,405,916	576,122	1,118,492	799,386	177,790	497,000			
STAND COMPOSITION BY % OF VOLUME									
<u>Tree Species</u>									
P. pine	37.6	55.6	36.4	40.6	48.0	54.28	30.7	56.7	
Sugar pine	16.4	9.8	23.0	26.9	6.9	20.47	20.3	16.3	
White fir	25.1	14.8	28.3	18.3	15.8	14.57	33.8	.06	
Douglas fir	11.1	8.2	1.2	6.2	17.9	1.96	1.8	24.24	
Incense cedar	3.6	11.3	2.2	7.5	11.4	8.69	8.5	2.7	
Red fir	1.2	.3	8.9	.05		.03	4.3	.0	
	100.	100.	100.	100.	100.	100.	100.	100.	
<u>Dunning tree classes</u>									
Class 1	8.8	5.96	5.82	9.49	15.68	8.45			
Class 2	2.1	2.11	2.43	1.95	2.86	2.81			
Class 3	12.9	13.99	13.58	21.02	23.17	17.53			
Class 4	6.8	5.90	5.85	8.23	3.03	8.15			
Class 5	47.4	60.85	59.62	53.15	53.93	54.15			
Class 5a	21.1	10.42	11.88	5.11	.96	7.10			
Class 6	.4	.35	.62	.54	.23	1.19			
Class 7	.5	.42	.20	.51	.14	.62			
	100.	100.	100.	100.	100.	100.			

Forest management plans and complete stand data not available for Silver Creek, Georgetown and Plum Creek units. Preliminary data used here are from the Land Acquisition Plan; A. M. Weber, 1940. Georgetown W. C. now being completed.

* Stand estimates for private land not available.

** Cutover has been increased by over 1,000 acres since Plan was prepared.

R. 10 E.

R. 11 E.

R. 12 E.

R. 13 E.

R. 14 E.

R. 15 E.

R. 16 E.

MICHIGAN
BLUFFS

AUBURN

T. 14 N.

LONG CANYON BLOCK

T. 13 N.

Robbs Pk.

T. 12 N.

GEORGETOWN

Bald
Mt.

SILVER CREEK

"A" PINO
GRANDESaddle
Mt.Big
HillBIG BEND
BLOCKSUGARLOAF
BLOCKKYBURZ
SILVER FORK
BLOCKSILVER FK.-ALDER CR.
ALDER CREEK
BLOCK

PLACERVILLE

BALTIC
BLOCKCAMP CREEK
BLOCKGRIZZLY
BLOCK

NORTH FORK BLOCK

CALTOR BLOCK

CAT
CREEK
BLOCKLeek Spg.
L.O.

T. 9 N.

CLEAR
CREEK

AMADOR

T. 7 N.

P.C.J. 12/44

UNITED STATES
DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY
AND PLANT QUARANTINE

FOREST INSECT SURVEY
ELDORADO
NATIONAL FOREST

BOUNDARIES

- Working Circles
- Blocks
- Sub-areas

SCALE
0
1
2
 MILES

Map I. 9. 1

1. Auburn Working Circle - Long Canyon Block

1. Reference - Forest Management Plan, Auburn Working Circle - Long Canyon Block. Benard Sweatt - 1944.
2. Timbered area - 38,518 acres.
3. Merchantable stand volume - 1,405,916 MBM
4. Cutover - none
5. Important infestation types - Western pine beetle in ponderosa pine;
Mountain pine beetle in sugar pine.
6. Conditions in virgin stand -
 - a. Susceptible species - Ponderosa, 37.6%; sugar pines, 16.4%; total, 54%. White fir (25%) has been moderately affected.
 - b. Maturity - 55% of the stand is overmature (Classes 4, 5 and 7). Most of the site is excellent with the older trees in large diameter classes. There is a fairly high percentage of mature low risk trees (21.1% in 5a).
7. Past losses - Records are entirely lacking. This area was not covered by the 1917 survey and is not mentioned in any of the Forest Service insect control reports. Snags indicate that past losses have been moderate, but sustained, with the stand neither gaining or losing very much in total volume. In some of the lower pine sites, snags are prevalent enough to indicate that there was a higher loss level some 10 to 15 years back which resulted in some depletion. White fir seems to have escaped any severe losses.
8. Current losses - Road counts of 1943 winter and 1944 summer ponderosa and sugar pines from Brushy Springs Guard Station to the South Fork of Long Canyon (11.0 miles) ran consistently high, about 14 trees per section - 85 board feet per acre. The south half of the area from Big Meadows to Nevada Point was much lighter, 2 trees per section - 10 board feet per acre. About 90 percent of this loss was in large diameter ponderosa pines.
9. Areas of bark beetle hazard. Because of maturity of the old stand, losses in the pine can be expected to continue. The competition of a heavy understory of young growth in many of the better sites can be regarded as a factor contributing to this hazard. Under adverse climatic conditions future loss may run into high volumes. The north half of the area has the highest present hazard as indicated by current losses.

2. Georgetown Working Circle

1. Reference -- Land Acquisition Plan. Weber, 1940
2. Timbered area - 10,822 acres
3. Merchantable stand volume - 240,208 MBM
4. Cutover - no data
5. Important infestation types - Western pine beetle-lps in ponderosa pine; Mountain pine beetle in sugar pine.
6. Conditions in virgin stands -

The merchantable stand in this area has been estimated as 56.7 percent ponderosa pine, 16.3 percent sugar pine, and 24.4 percent Douglas fir. The pine stands appear to mature early and do not reach large volumes. The study now underway by the Forest Service to provide the basis for management plans for this working circle will analyze stand conditions thoroughly and a satisfactory entomological appraisal can best be made when these data become available.

7. Past losses - In 1917 the estimate of losses was 5 board feet per acre. Apparently the eastern part of this unit was affected by the epidemic loss cycle of 1929-32 as evidenced by occasional groups of old snags now on the ground.

In 1929 the Forest Service reported losses around Slate Mountain at 600 ponderosa and sugar pines on 3800 acres or about 100 trees per section. In the winter of 1941 the CCC control project treated 403 infested ponderosa and sugar pines on 6000 acres around Slate Mountain. The overwintering loss on this area was therefore around 42 trees per section or 43 board feet per acre. The annual loss, made up of the total 1940 summer and winter trees, must have been considerably higher although no data are available. In August 1941 J. M. Miller looked over the Tunnel Hill area and found some localized group attacks in ponderosa pine involving an area of about 3,000 acres. This condition subsided the following season.

8. Current losses - In the spring of 1944, 11 ponderosa pines were treated in the area just south of Slate Mountain. Counts made in August of 1943W and 1944S trees from Bald Mountain Lookout indicate a loss of about 6 trees per section and 10 board feet per acre. The loss appears to be even lighter toward the western part of the unit.

9. Areas of bark beetle hazard - The highest hazards in this area appear to be in the eastern and southeastern part of the unit in the Whaler and Mosquito Creek drainages. It would be of advantage to make a more detailed survey of hazard conditions in connection with the formulation of management plans now underway.

3 - Silver Creek Working Circle

1. Reference - Land Acquisition Plan. Weber, 1940
2. Timbered area - 83,500 acres
3. Merchantable stand volume - 1,405,916 MBM (Gov't)
4. Cutover - About 40 percent
5. Important infestation types - Western pine beetle-Ips in ponderosa;
Mountain pine beetle in sugar pine;
Fir engraver beetle in white fir.
6. Conditions in virgin and cutover stands -

Basic data on composition are lacking; preliminary estimates give 51 percent ponderosa pine and sugar pine, 33.8 percent white fir. This unit, with its present boundaries contains a widespread of type and site conditions, varying from low quality ponderosa pine on sites III and IV to sugar pine-fir type on sites I and II. For entomological purposes it can best be divided into three sub-areas, designated in map figure 1 as "a," "b" and "c."

Sub-area a. This includes virgin stands of the lower pine type in the Whaler Creek and Brush Creek drainages very similar to those in the Georgetown unit. Trees reach early maturity and become susceptible to bark beetle attack especially on the poorer sites.

Sub-area b. This is composed almost entirely of cutover lands which include most of the acreage in Ranges 12 and 13E, Township 12N. The age of cutover varies from recent cuttings to areas that were logged some 30 years back. No entomological problems have been reported in these cutover stands.

Sub-area c. Includes fine virgin stands of the ponderosa, sugar pine and fir type east of R.13E in the Little Silver, Silver Creek and Gerle Creek drainages. The stand is highly mature and is mostly privately owned.

7. Past losses -

Sub-area a. The 1917 survey shows a very light loss per acre, with some concentration of infestation in the Slate Mountain and Whaler Creek areas. The Forest Service's report for 1931 estimated 1100 ponderosa pine on 3000 acres in Brush Creek, or about 138 trees per section. The estimate for 1932 was 24 ponderosa and sugar pine and 24 Douglas fir per section in Mesquite and Brush Creeks. According to the spotting map prepared by Mr. Kincaid about half of the trees treated by the CGC control work in 1941 were in this part of the Silver Creek working circle.

Sub-area c. The 1917 survey recorded a negligible loss of about 3 board feet per acre. Such losses as have occurred have been mainly in sugar pine. Snag conditions indicate that losses have been very moderate.

except in the Little Silver drainage where a snag count indicated that the average annual loss in sugar pine for the past 15 years has been around 90 board feet per acre; this is definitely much higher than in the main Silver and South Fork of the Rubicon drainages.

8. Current losses -

Sub-area a. Counts of 1943W and 1944S trees from Slate Mountain lookout and on a roadstrip from Slate Mountain to Pino Grande indicate a loss of 7 trees per section and 15 board feet per acre. About 25 percent of this loss is in sugar pine.

Sub-area c. Road counts through the Little Silver and main Silver Creek drainages and from the Big Hill Lookout indicate a loss of about 5 trees per section and 13 board feet per acre, practically all sugar pine. No appreciable loss was noted in the South Fork of the Rubicon drainage. It is worthy of note that the giant sugar pine, 122 inches d.b.h., on the Michigan-California holdings in Silver Creek was killed by the mountain pine beetle in the fall of 1943.

9. Areas of bark beetle hazard - Because of site conditions the hazard is relatively high in the ponderosa-sugar pine stands over much of sub-area a, and under adverse climatic conditions group-killings may occur with heavy losses. For sub-area b the general hazard is fairly light except in the Little Silver drainage where logging operations are now being advanced. Losses of large mature sugar pines can be expected to continue regardless of site.

4. Big Bend Working Circle

1. Reference - Management Plan, Big Bend Working Circle. A.N.Weber, 1939
2. Timbered area - 20,718 acres
3. Merchantable stand volume - 576,122 MBM
4. Cutover - 2,240 (1939)
5. Important infestation types - Western pine beetle-Ips in ponderosa pine;
Mountain pine beetle in sugar pine;
Fir engraver in white fir.
6. Conditions in virgin stand -

a. Susceptible species - Ponderosa pine, 55.6%; sugar pine, 9.8%; white fir, 14.8%; total, 70.2%.

b. Maturity - 67.17% of stand in mature and overmature classes 4, 5 and 7. The south slopes of the American River Canyon which run to a very high percent of ponderosa pine make the western pine beetle-Ips problem dominant in this unit.

7. Past losses - The 1917 survey found most of the loss in this unit on the slopes of the American River Canyon, particularly in the Big Bend Block. The estimated loss was 7 board feet per acre. In 1931 the Forest Service's report estimated 4000 ponderosa pine on 20,000 acres, which would indicate 170 trees per section. This high estimate per section apparently was the result of the 1929-30 group killing and includes a high percent of trees of pole size. The great number of old snags, most of which are now down, supports this 1931 estimate. Sugar pine losses have been relatively low in this area and have largely occurred in the Big Bend Block. In 1934 a control project on NIRA funds expended \$5600 in areas visible from the Lincoln highway in the American River canyon, but records of the volume treated are lacking.

8. Current losses - Lookout counts of 1943W and 1944S trees indicate a loss of 7 merchantable trees per section and 16 board feet per acre on the south slopes of the American River Canyon. Practically all of this is in ponderosa pine. Some top-killing of mature trees and group killing of ponderosa poles by Ips occurred in the fall of 1943.

9. Areas of bark beetle hazard - The southern slopes of the American River Canyon are susceptible to sporadic outbreaks of western pine beetle-Ips infestation during drought periods like that of 1929-31. Such outbreaks are likely to occur at relatively long intervals with heavy local losses in ponderosa pine but with relatively low loss levels between epidemics.

5. Plum Creek Working Circle

1. Reference - Land Acquisition Plan. Weber, 1940
2. Timbered area - 21,157 acres
3. Merchantable stand volume - 40,000 MBM
4. Cutover - 10,500 acres. 50% of timbered acreage
5. Important infestation types - Western pine beetle-lps in ponderosa pine; Mountain pine beetle in sugar pine; Fir engraver in white fir.

6. Conditions in virgin stands - No analysis of stand composition is available. Most of the pine in this area has been cut over and such infestation problems as now exist appear to be limited to fir.

7. Past losses - Jaenicke included the area in his Iron Mountain unit and found some losses in the Plum Creek drainage in 1917; his estimates running around 6 board feet per acre. The area has not been mentioned in any subsequent reports.

8. Recent losses - No estimates attempted in recent surveys.

9. Areas of bark beetle hazard - The high percent already cutover and the rapid cutting now under way will soon limit all hazards to these peculiar to cutover stands. This phase will need further study.

6. Alder Creek - Silver Fork Working Circles

1. Reference - Management Plan, Alder Creek - Silver Fork Working Circles. An N. Weber, 1939
2. Timbered area - 31,065 acres
3. Merchantable stand volume - 1,118,492 MBM
4. Outover - 1,463 (1939)
5. Important infestation types - Western pine beetle-Ing in ponderosa pine; Mountain pine beetle in sugar pine; Jeffrey pine beetle in Jeffrey pine; Fir engraver in white fir.
6. Conditions in virgin stands -
 - a. Susceptible species: Ponderosa pine, 36.4%; sugar pine, 23%; white fir, 28.3%; total, 87.7%.
 - b. Maturity - 65.6% of stand in mature and overmature classes 4, 5 and 7. Only 22.45% in thrifty classes 1, 2, 3 and 6.

Growth conditions and stand composition vary widely between the northern slopes, where fir and sugar pine predominate; and the southern slopes where ponderosa and Jeffrey pines predominate.

7. Past losses - Jaenicke found only negligible losses in this area. Snags indicate that there have been low but sustained losses of ponderosa and Jeffrey pine on the ridges and southern slopes; loss in the better sites has been mostly in sugar pine. In past reports reference to losses in this unit are found only in connection with the Lyburn burn of 1932. Following this fire the mountain pine beetle developed in fire-injured trees and by 1934 was attacking trees around the borders of the burn. During the winter of 1934-35, 300 infested sugar pines were treated on 200 acres in the vicinity of High Cliff.

8. Current losses - Counts of 1943W and 1944S trees from the Alder Ridge lookout indicate that in the northern part of the unit 75 percent of the current loss is in sugar pine; in the central and southern part of the unit most of the beetle-killed trees were ponderosa pine. The annual loss for 1943 was estimated at 5 trees per section or 1.8 board feet per acre.

9. Areas of bark beetle hazard - The present ratio of loss and growth in these mature stands seems to be in a balanced condition and areas of very high hazard are fairly small. Ridges and southern slopes represent the areas where infestations are most likely to occur and these should be watched for evidence of an increasing loss cycle.

7. Caldor Working Circle

1. Reference - Timber Management Plan, Caldor Working Circle. A. N. Weber, 1940.
2. Timbered area - 50,672 acres
3. Merchantable stand volume - 799,386 MBM
4. Cutover - 32,453 acres
5. Important infestation types - Western pine beetle-Ips in ponderosa pine; Mountain pine beetle in sugar pine; Fir engraver beetle in white fir.
6. Conditions in virgin pine stands -
 - a. Susceptible species: Ponderosa pine, 40.6%; sugar pine, 26.9%; white fir, 18.3%; total, 85.8%.
 - b. Maturity - 61.9% of the stand is in mature and overmature classes. The high percent of cutover in this unit limits the bark beetle problem to rather specific areas of remaining virgin stands. The Baltic and Northfork blocks contain some areas of fairly mature ponderosa pine which will be subject to a varying amount of western pine beetle attack. The Cat Creek block contains a stand of mature sugar pine subject to mountain pine beetle attack.

7. Past losses - In 1917 Jaenicke laid out the Caldor infestation unit to include the present Cat Creek, Pipi and Caldor blocks and the drainage of Steeley Creek. He found ponderosa pine losses in the western part of this unit particularly in the drainages of Canyon Creek, Steeley Creek, and Middlefork of the Consumnes; very light sugar pine losses were recorded in Cat Creek. His estimate for the entire unit of 12 board feet per acre was the highest recorded on the 1917 survey.

In 1929 the Forest Service reported very heavy infestations in white fir poles. The unit is not mentioned in further reports until 1944.

8. Current losses - Spotting from Baltic lookout indicated that the 1943W-1944S loss ran about 6 trees per section or 10 board feet per acre. Practically all of this was ponderosa pine in the Northfork block. Losses in old cutover of the Caldor and Pipi blocks were negligible. In the Cat Creek and the upper Pipi block the current loss ran 5 trees per section, or 15 board feet per acre, about 40 percent sugar pine.

In the fall of 1943 a local outbreak developed in the Steeley Creek drainage of the Northfork block near the Plummer Ridge guard station. This consisted of group killing by Ips and western pine beetle in the reserve stand of pine on or near recently cutover lands. Approximately 152 trees ranging from pole-size to 30 inches D.b.h. were treated on 1,000 acres in the spring of 1944. It was estimated that an additional 100 trees in and around the area were not treated. This infestation apparently was connected with the slash on logging operations which had closed down in the vicinity. Climatic conditions in the fall of 1943 may also have had some part in stimulating this outbreak.

9. Areas of bark beetle hazard - Stands of mature ponderosa pine on southern slopes in the Camp Creek, Northfork blocks contain some degree of hazard from western pine beetle, although recent losses have been light. Sugar pine in the Pipi and Cat Creek blocks ranks next in hazard.

8 - Clear Creek Working Circle

1. Reference - Management Plan, Clear Creek Working Circle. A. N. Weber, 1940.
2. Timbered area - 11,500 acres
3. Merchantable stand volume - 177,790 MBM
4. Cutover - 4,204 acres
5. Important infestation types - Western pine beetle-ips in ponderosa;
Mountain pine beetle in sugar pine;
Fir engraver in white fir.
6. Conditions in virgin pine -
 - a. Susceptible species - Ponderosa pine, 48%; sugar pine, 6.9%; white fir, 15.8%; total, 70.4%
 - b. Maturity - 57.10% of stand is in mature and overmature classes 4, 5 and 7; 41.94% in thrifty classes 1, 2, 3 and 6. Douglas fir and incense cedar make up 29.3% of the stand and may develop some insect problems when conditions become favorable; however no trouble has been reported in these two species to date. The unit is primarily in the lower pine type and the western pine beetle-ips problem is likely to be dominant.
7. Past losses - No estimates of bark beetle losses on this area are found in any of the Forest Service reports. Snag conditions do not indicate that any severe losses have occurred. It is possible that the composition of the stand with a relatively high percent of Douglas fir and white fir may have been a factor in holding down pine losses. In 1942 top-killing of ponderosa pine in the area was reported and investigated, but was found to be of minor importance.
8. Current losses - 1943W-1944S trees from road counts and spotting from Armstrong Hill lookout were estimated at 5 per section and 14 board feet per acre; practically all ponderosa pine.
9. Areas of bark beetle hazard - The general hazard of beetle infestation is low and relatively uniform throughout the area.

9. Amador Working Circle

1. Reference - Forest Management Plan, Amador Working Circle.
A. N. Weber, 1941
2. Timbered area - 16,074 acres
3. Merchantable stand volume - 497,000 MBM
4. Outover - 215 acres
5. Important infestation types - Western pine beetle-ips in ponderosa pine; Mountain pine beetle in sugar pine; Fir engraver beetle in white fir.
6. Conditions in virgin stand -
 - a. Susceptible species - Ponderosa pine, 54.23%; sugar pine, 20.47%; white fir, 14.57%; total, 89.32%.
 - b. Maturity - 70% of stand in mature and overmature classes 4, 5 and 7.
7. Past losses - Jaenicke found ponderosa pine losses predominating in 1917, with an estimated loss of 8 board feet per acre. In 1931 the Forest Service reported 816 infested ponderosa pine on 5,000 acres or about 102 trees per section on "Mokelumne Hill." An additional 7500 acres of government timber was listed as infested but not estimated. In the fall of 1935 Bureau of Entomology and Plant Quarantine personnel estimated that about 45 trees per section were killed on the Mokelumne River slopes. A further mention of the area was made by the Forest Service in 1939, which reported "increased losses in both ponderosa and sugar pines."
- Snag conditions indicate that there was fairly heavy group killing of ponderosa pine on the southern exposures during the epidemic period of 1929-33. Sugar pine losses were also heavy during that period. Since then losses in both species have been low, but sustained.
8. Current losses - Current losses are low over most of the unit. A spotting of 1943W-1944S trees from Pegler Hill and 7 miles of road strips from Lumberyard Ranger Range on Beaver ridge and Panther ridge indicate a loss of 4 trees per section and 12 board feet per acre, mainly ponderosa pine. Sugar pine losses were found to be heavier in the western part of the area between the Alpine highway and Doakes ridge where on an area of 4 sections the 1944 loss was around 10 trees per section.
9. Areas of bark beetle hazard - Since greater part of this unit comprises the southern exposures of the Mokelumne River Canyon, the bark beetle hazard is fairly uniform. The losses on these sites are most likely to be of the western pine beetle-ips type, touched off by ips top-killing and occurring at rather long intervals. When climatic conditions are right, group killing and high peak losses can be expected.

IV. FOREST INSECT CONDITIONS IN RECREATIONAL AREAS

Forest insect infestations in the special use tracts, resort sites, summer homes and campgrounds on this Forest have received attention for a number of years and will no doubt continue to do so. Special conditions arise where the Forest is used for these purposes and the considerations that warrant control in commercial pine areas no longer apply. On areas devoted chiefly to recreational uses, board foot loss per acre or trees per section have little significance. Where trees are valued for cover, shade and the esthetic interest which they lend to the landscape, the loss of one or two trees on an improved lot or campground can effect property values as much as the loss of a high volume of timber in a commercial stand.

These areas where light forest insect infestations have been important are largely grouped in the Lake Tahoe region. Private ownerships make up the bulk of the developed tracts, but the Forest Service has cooperated with and guided the owners in dealing with insect infestations in many of the cases that have come up.

1. The More Important Infestation Types.

Bark beetles follow the host trees into these higher elevations and the species that have been encountered are much the same as those found in the lower commercial timber. The species which have caused most of the trouble in the Tahoe areas are listed here in the approximate order of their importance.

Fir engraver beetle in white fir has been prevalent throughout the Tahoe region and during epidemic periods has caused general concern. This beetle produces various types of injury such as topkilling, injury to bole and limbs by partial attacks, or killing of the entire tree. During 1929-31 large groups of trees were killed outright. Due to its habits of maintaining an infestation by partial attacks in green trees, general control by reduction of beetle population would require the cutting of many living trees. Because of this factor control work has not been recommended or attempted in recreational areas. Lot owners have sometimes practised tree surgery on the top-killed trees.

Mountain pine beetle in lodgepole pine. Epidemics have been quite destructive by killing trees in large groups. Control work in the Echo Lake and Fallen Leaf tracts has been effective in eliminating the epidemic conditions.

Jeffrey pine beetle in Jeffrey pine. Large mature trees widely scattered in distribution have made up most of the loss. The amount of killing fluctuates annually. Control work around Fallen Leaf Lake in 1932-33 was effective.

Turpentine beetle in all pines. This is the insect most commonly reported by summer home owners. Its habit of attacking trees around new buildings and causing large conspicuous pitch tubes near the ground has caused the

owners no end of concern. Although it is usually drowned out by pitch flow and rarely kills the trees, frequent complaints are received because of its activity. A special information circular has been prepared by the Forest Insect Laboratory to help in dealing with this problem.

Mountain pine beetle in sugar pine occurs in the areas on the westside of Lake Tahoe and has recently caused some loss on the poorer sites.

2. Infestation areas.

So far no attempt has been made to divide the Lake Tahoe areas into reporting units. Since the nature of the forest insect problems vary with different localities, it is of advantage to break the general area down into infestation units which can be reported upon individually. Seven such areas are outlined in the map (Figure 2) on the next page.

a. Meske Bay.

During the period from 1929 to 1937 a great amount of damage was done to both old and young white fir in this area by the fir engraver beetle. Old logging operations west of the developed tracts along the lake shore and highway have removed most of the pine and insect damage has been a minor factor in these species. Current infestations are endemic in all types. The fir engraver beetle is still attacking occasional trees, but the damage is very light.

b. Emerald Bay.

This area includes the rocky sites of the western lake shore extending from Rubicon Point to Angora ridge. The stand is all aged and includes Jeffrey pine, sugar pine, white fir and some lodgepole. Because of the poor sites and difficult terrain, early logging seems to have by-passed most of the area.

There has been a fairly continual loss in Jeffrey pine, mostly made up of scattered large mature trees; white fir was hit hard by the 1929-37 epidemic; sugar pine losses have been noticeable in recent years in the State Park and around Emerald Bay. In 1931 the Jeffrey pine beetle was causing more than endemic losses in the vicinity of Fallen Leaf Lake and a cooperative control project was carried on for several subsequent seasons by the Baldwin estate and the Forest Service. Both Jeffrey pine and lodgepole pine were treated. Current infestations are endemic except for a slight increase by the mountain pine beetle in sugar pine.

c. Lake Valley.

The western part of this unit has an old stand of Jeffrey pine and fir on poor sites, some of which is now being cut over. On the good sites of the valley floor old logging seems to have removed the mature stand and this more northern part of the area is now stocked with a thrifty young stand of Jeffrey pine which so far has been free of insect problems. The mountain pine beetle epidemic of 1929-37 killed an appreciable percentage of the lodgepole pine on meadow and stream sites in the southern part of this area, but no important recreational tracts were affected. Current losses are endemic in all types.



d. Upper Truckee.

Jeffrey pine and fir make up most of the type in this canyon area. Lodgepole occurs along the stream sites. The Jeffrey pine beetle has taken a low but fairly constant toll of large mature Jeffrey pines throughout the area. The mountain pine beetle epidemic from 1929-37 ran through all of the lodgepole pine in the canyon bottom and was the cause of the great number of snags in these stands. No control work has been done in this area, probably because no recreational tracts have been affected by bark beetle infestations. Current losses are endemic.

e. Echo Lake.

Much of the alpine forest type in this area consists of lodgepole pine and western white pine growing in glaciated granite basins. Red fir and some white fir occupy the better sites. Damage to red fir was heavy during the 1929-37 epidemic. In 1930 the mountain pine beetle was found to be killing lodgepole and white pines in groups on the intensively developed summer home tracts around the upper lake. The Forest Service carried out a control project in the spring of 1931 and treated 76 lodgepole and 24 white pines. This work broke up the epidemic, and losses since then have been negligible. No evidence of current bark beetle infestations was found in this area in an examination made in August 1924.

f. Phillips.

This area includes the highway strip from Sayles Flat to Echo summit. The eastern part is occupied by mature lodgepole pine. The age and density of some of these lodgepole stands indicate susceptibility to mountain pine beetle epidemics, although no losses have occurred to date. Jeffrey pine and fir compose the forest type outside of the lodgepole sites. There is little evidence of old bark beetle activity and current conditions are endemic.

g. Strawberry.

This area borders the highway from Pyramid Ranger Station to Sayles Flat. The forest type is mixed conifer with Jeffrey pine, ponderosa pine, sugar pine, white fir and red fir. In the past there have been light but sustained losses in Jeffrey pine and sugar pine with a normal amount of damage to fir. Two large Jeffrey pines were killed near Strawberry in 1943, but conditions can be considered as endemic in all types.

Other Areas.

There are other areas in the Forest where recreational interests are paramount that have not been included in forest insect surveys. The only reference in past reports to areas outside of the Lake Tahoe region is Knights Lake where a special examination was requested in 1931. Subsequent reports contain no information on conditions in this area.

V. CONTROL CONSIDERATIONS

The bark beetle problem in the commercial forests of the Eldorado centers around protection of the pine stands. Other species, principally fir, cannot be dismissed; but the lower timber values, the nature of infestations in fir stands, and the lack of satisfactory control measures for the fir engraver beetle make it necessary for the present to give higher priority to bark beetle infestations in pine.

Cutover areas.

Available data for the Eldorado indicate that about 30 percent of the commercial areas are now in cutover status of various ages and degrees of cutting. The past behavior of beetle infestations on these cutover stands has been sporadic. Over long periods only negligible damage has occurred, but there have been occasional flareups of beetle activity of short duration. When serious damage on cutover has occurred, it has usually started with Ips infestations. As time goes on and these new stands begin to approach maturity, we can expect that the types of bark beetle infestations now common in virgin stands will begin to appear.

Direct control seems to be the only practicable way of dealing with infestations that may become serious in cutover stands. This was done on the Steeley Creek area in the spring of 1944 when active western pine beetle-Ips outbreaks were found to be depleting the reserve stand on recent cutover.

Virgin pine stands.

The purpose of a control policy in commercial forests is to maintain suppression of beetle infestations either by direct or indirect methods to an extent that will insure maximum yield from these stands when the day of logging arrives. The virgin pine stands of the Eldorado are characterized by a high percent of mature and overmature trees. Potentially all of these old stands are susceptible to bark beetle attack, but except where special conditions have developed, past infestations have been of slow momentum and have not depleted the stand much faster than the loss is being replaced in the long run by new growth in surviving trees. Where there is little possibility of early logging, this static condition can be tolerated; however, where an area is to be logged within a few years, the loss from even an endemic infestation takes lumber values out of the stand that cannot be replaced within a short period.

Except for local areas this balance of loss and increment seems to have been the status in pine stands of the Eldorado over a long period. How long this condition may persist is something that cannot be predicted. In other forests of this region, it has been found that some mature pine stands have started to disintegrate rather suddenly under the impact of epidemic infestations and heavy depletion has resulted within a ten-year period. Management through selective cutting practices to remove the

overmature trees and those showing high risk characteristics offers the best insurance against current and potential beetle losses. This form of control is necessarily dependent upon transportation and milling facilities and where these are lacking, direct control is the only available means of holding down losses.

Indirect Control.

The methods of treatment by selective logging to reduce the hazard of bark beetles may vary from logging only the immediate high risk trees (sanitation-salvage) to a cut of 25 to 50 percent of the stand to remove all of the mature and overmature trees. Economics and silviculture, as well as entomological considerations, should enter into selection of programs best suited to individual areas.

Indirect control through logging is a method of recent origin and so far has been developed and tested only in eastside pine areas which differ in their composition from the Westside mixed conifer types of the Eldorado. To develop concrete plans for sanitation-salvage or heavier selective cuts in the Eldorado working circles would require special studies of risk and hazard in areas selected for treatment.

On the basis of the brief reconnaissance examination made in August 1944, the following comments are offered on units where indirect control may be feasible.

Georgetown Working Circle. Bark beetle hazards in the pine stands of this working circle appear to become operative in stands of relatively early ages. Because of accessibility there should be good possibilities for preventing future beetle losses through a well planned management program and selective logging. It would be of definite advantage to include a risk and hazard appraisal in the management study which the Forest Service now has underway on this working circle.

Long Canyon Chance. The volume of high quality timber now being lost on the north half of this unit should warrant sanitation-salvage control. Lack of roads, topography and the heavy stand are factors which may make selective logging so expensive a proposition as to outweigh the benefits of salvage. Direct control may be the only practical answer if the present increasing trend continues.

Big Bend and Alder Creek - Silver Fork Working Circles. For the present indirect control can be considered only for local areas in connection with going logging operations. Some possibilities exist in the Big Bend and Alder Creek - Silver Fork working circles where overmaturity of stands are high and current operations would offer some outlet for salvage. Some studies to further explore these possibilities would be advisable.

Direct Control.

The cut-peel-burn method of bark beetle control is still the best that has been developed for immediate attack upon threatening infestations. Although this method usually involves the sacrifice of lumber values in

the infested trees, its use is often warranted on commercial stands where timber values are high and serious losses are in prospect. In the recreational areas intensive maintenance control by direct methods is about the only type of protection which will satisfy the great number of people who use these areas for summer homes or visit them yearly on outing trips. Future situations will develop as they have in the past where direct control will be the only means of dealing with important situations.

Surveys.

Justification for annual bark beetle surveys on the Eldorado lies in the fact that present timber estimates show that the Forest still has some six billion feet of virgin timber, much of which is overmature and subject to potential bark beetle hazards. Added to this consideration is the highly developed use of forest areas for summer homes and other recreational developments around Lake Tahoe and in the American River Canyon. Protection of these high values against damage by forest insects can be effectively maintained only if detection surveys are made annually.

The intensity of the surveys that are undertaken may vary with the timber values that are involved and the character of the infestations. As long as bark beetle losses remain at low levels, surveys of the reconnaissance type, using lookout points and road strips as the basis for general estimates, may be sufficient. When control action is needed, estimates and control plans should be based on more detailed examination of sample plots.

In order that detection surveys may serve the purpose of a long-term protection program, it is recommended that permanent sample plots, road strips and observation points be selected and that annual records of bark beetle losses be maintained on these areas. It is important that the sample areas represent types where the highest timber values exist and where there are potential bark beetle hazards. Undoubtedly a considerable amount of territory can be excluded from intensive surveys because such timber losses as may occur will be of little concern.

Sample plots of the half-section type provide a useful record for research as well as control purposes. However the work of cruising such plots is time-consuming and it is suggested that the number be limited to two plots in order to keep the survey within reasonable time limits. One plot in the lower pine type and one in the sugar pine-fir-ponderosa type will yield valuable records from this central Sierra region.

Road strips are most useful in providing an index to the amount and distribution of bark beetle losses. Before permanent road strip samples are selected, a study should be made of the road systems of the Forest to determine which runs will give the best index to conditions within the established infestation units.

Complete location data for all permanent sample plots and road strips should be available to both the Eldorado National Forest and the Forest Insect Laboratory, and the annual surveys conducted on a cooperative basis so that both agencies may be informed on current conditions.

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